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## mod. IO-CB/DO-08RL-00

M.U. IO-CB/DO-08RL-2/07.07  
Cod. J30-478-1AD0-08RL E

# User manual

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## CANopen I/O module

### 8 Relay Digital Outputs

## mod. IO-CB/DO-08RL

### 8 relay digital outputs



Each of the Output terminals can be programmed as either a standard optoisolated Output or performing:

- single pulse output.

### WARNING

1) The product described in this manual should only be installed, operated and maintained by qualified application programmers and software engineers who are familiar with automation safety concepts and applicable national standards.

2) This product supports the Parameter defaults indicated by CiA standards, in addition, some parameters have a factory set (value present in the module when comes from the factory). The default values can be loaded with the restore command, but after the restore, factory set values are lost.

## APPLICABLE STANDARDS

The DO-08RL module is suited for the CiA DS301 protocol [1] and implements the CiA DS 401 standard Device Profile [2].

## Characteristics

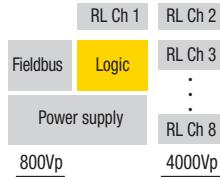
### Technical data

Number of channels	8
Polarity	4 channels SPST NO + 4 channels SPDT 4 channels SSR instead of 4 SPST NO (option)
Load max. voltage	250 Vac
Load max. current	SPST 2 A SSR 1 A (above 25°C derate linearly to 0.5A at 65°C)
Load min. current	SSR 20 mA
Max. total current	16 A
ON/OFF delay	SPST <5 ms SSR 11 ms
Single pulse duration	Min. 5 ms Max. 65535 ms
Mechanical life	20x10 <sup>6</sup> cycles
Electrical life (2A, 250 Vac)	1x10 <sup>5</sup> cycles

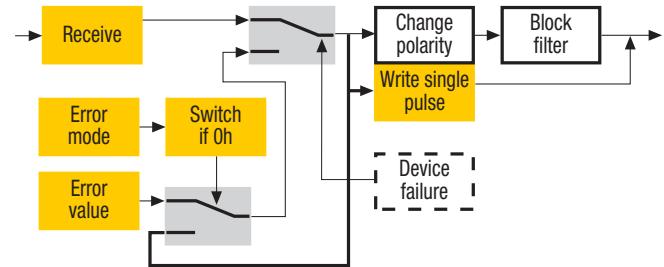
### General

3 way isolation	Channel to Channel	4000 Vp
	Channel to Logic	4000 Vp
	Logic to Serial Bus	800 Vp
	Power Supply to Logic	800 Vp
Power supply	24 Vdc; -15...+25%	
Power consumption	3.5 W	
Dimensions	L: 152; H: 110; W: 65	
Weight	400 g	
Safety regulations	Isolation class II (250 Vrms) Installation category II Pollution degree 2	
EN61010-1		
CE marking	EN61131-2	

### 3 way isolation diagram



### Functional Block Diagram



### PDOs used by the module

RPDO	Properties	Mapped objects	Index	Sub-index
RPDO 1	COBID: 200h + NodeID Transmission Type: 01h *	DigOutput 8_1	6200h	01h
RPDO 2	COBID: 300h + NodeID Transmission Type: 01h *	Start/Stop mode	200Dh	00h

Note: \* The Transmission Type is configurable:

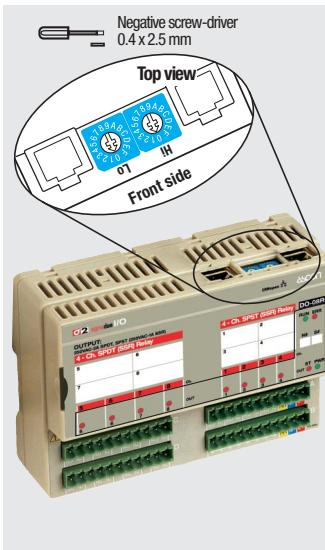
01h is the factory set (value present in the modules when come from the factory);  
FFh is the default value.

### Environment

	Operating	Storage
Temperature	-10...+65°C	-40...+85°C
Relative Humidity	5...95% non condensing Appropriate measures must be taken against humidity >85%	5...95% non condensing For a short period, slight condensation may appear on the housing
Mounting	Vertical, free air	
Protection	IP20	
Vibrations (3 axes)	10...57Hz 0.0375mm 57...150Hz 0.5g	
Shock (3 axes)	15g, 11ms half sine	

## Hardware Set-up

### Hexadecimal rotary switches, service and I/O LEDs



Service LEDs	Status	Meaning
RUN	ON	Operational
	Blinking	Pre-operational (CANopen)
	Single flash	STOPPED
	OFF	Device in RESET state
ERR	ON	BUS OFF
	Single flash	Warning limit reached
	Double flash	Error Control Event
	Triple flash	Sync Error (CANopen)
ST	OFF	No error. Device working
	ON	DIAG Error
	Blinking	INIT and DIAG running
	Single flash	Baud rate setting
PWR	OFF	Module OK and ready
	ON	Module Power Supply ON
	OFF	Module Power Supply OFF
I/O LEDs	Status	Meaning
OUT1...8	ON	Output active
	OFF	Output inactive

### Bit Rate and Node ID configuration

#### Bit rate

Lo switch	Baud rate kbps	Bus length m
1	20	2500
2	50	1000
3	100	500
4	125	500
5	250	250
6 *	500	100
7	800	50
8	1000	25

#### Node ID

Hi switch	Lo switch	Valid ID Node
0	1	01h (address 1)
0	2	02h (address 2)
↓	↓	↓
7	F	7Fh (address 127D) *

Notes: \* Default value

### Procedure for Node ID and Bit Rate configuration

The HI and LO hexadecimal rotary switches set the module's Bit Rate and CAN Node ID. During the configuration, the module must be **off line** and the CAN bus must be physically disconnected.

To configure the module, follow the procedure:

- 1 Turn the Power OFF
- 2 Set the **HI** switch to "F"
- 3 Select the desired Bit Rate value by setting the **LO** switch following the table (e.g. "8" for 1 Mbps)
- 4 Turn the Power ON
- 5 Shift the **HI** switch to "E" (all the module service LEDs should flash)
- 6 Turn the Power OFF. Now configure Node ID
- 7 Set the **HI** and **LO** switches to the desired valid Node ID following the table
- 8 Turn the Power ON.

Alternatively, at step 7 set the value 00h. Then, at the next Power ON, the last valid stored value will be resumed as Node ID.

Default values: Bit Rate = 500 kbps, Node ID = 127D

## Parameter configuration

### Configuring the Output Channels

The Output functional block diagram is consistent with the standard profile CiA DS401 [2].

#### Index 6200h – Write Output 8-bit

This object writes a group of 8 outputs:

1 = output active,

1 = output not active.

The output signalling from a CAN message is processed first.

Two preprocess items are performed:

#### • Polarisation Index 6202h – Polarity Output 8-bit:

This object defines the polarity of 4 output lines.

Output polarity can be inverted individually.

1 = output inverted;

0 = output not inverted.

If the object is not supported, the device behaves according to the default value.

#### • Masking Index 6208h – Filter Mask Output 8-bit

This object defines an additional output filter mask configurable for 8 outputs.

1 = output is set to the received output value

0 = do not care, the received output value is neglected for the corresponding output channel and the old output value is kept.

If the object is not supported, the device behaves according to the default value.

### Error mode

In error mode, the outputs behave according to the following two entries:

#### Index 6206h – Error Mode Output 8-bit:

This object indicates, whether an output is set to a pre-defined error value (see 6207h object) in the event of an internal device failure or of a 'Stop Remote Node' status.

1 = output value takes the pre-defined condition specified in object 6207h

0 = output value is kept if an error occurs

#### Index 6207h – Error Value Output 8-bit:

On condition that the corresponding Error Mode is active, device failures set the outputs to the value configured by this object.

0 = Output is set to '0' in case of fault, if object 6206h is enabled

1 = Output is set to '1' in case of fault, if object 6206h is enabled

### Proprietary output functions

In addition to the expected functions, the module provides a proprietary output function option. Output/function combinations are fixed, and determined by the value of the entry in the table below:

#### Index 2003h – Output options

Value	Allowed options
0	No option
1	Pulse on channel 1
2	Pulse on channel 2
3	Pulse on channel 3
4	Pulse on channel 4
5	Pulse on channel 5
6	Pulse on channel 6
7	Pulse on channel 7
8	Pulse on channel 8

#### • Generation of a single pulse of programmable width

#### Index 200Bh – Output Pulse Value:

Assigns the value of the duration of the pulse within a range from 5ms to 65535ms, in 5ms steps. Please note that the Output Pulse Value has to be expressed in ms.

#### Index 200Dh – Start Stop Mode:

In RUN mode, this entry determines the trigger of the pulse. It should be noted that the pulse function is not subject to polarity and filter mask. The generated pulse consists of a Low-to-High edge and, at the end of programmed width, of an High-to-Low edge:

bit 0 → Start (1) ch. 1 ... bit 7 → Start (1) ch. 8

Please note that bits 0...7 are automatically reset by the device, i.e. they are ready for any subsequent pulse.

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Ch. 8	Ch. 7	Ch. 6	Ch. 5	Ch. 4	Ch. 3	Ch. 2	Ch. 1

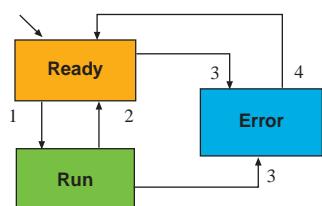
0 = Stop

1 = Start

## Commands

## Index 200Ch – Operating mode:

the device has its own internal state machine. It is possible to move through this by sending appropriate values to the Index 200Ch, following the table below.



## SDO Messages

The entries of a device Object Dictionary are accessed through SDO (Service Data Object) messages. The basic SDO messages are as follows, as based on the Client – Server request and response model:

\* This code is type dependant.

Please refer to the CIA DS301 Profile for more details.

Transition	Operating mode value	Behaviour
Init	-	At Power-Up, the Device is in the “ready” state. Transition 1 is also executed if Index 200Ch - Operating Mode contains the default value 1
1	01h	Operating mode “RUN” is activated
2	00h	Return to the initialisation “ready” state. The transition is performed: <ul style="list-style-type: none"> <li>• following an operator’s command</li> <li>• after assigning the configuration parameter (2003h)</li> </ul>
3	FFh	The “error” state is automatically assigned by the device (and the operating mode value is read only) when: <ul style="list-style-type: none"> <li>• an attempt is made to execute an unexpected command</li> </ul>
4	00h	This value causes an exit from the “error” state, after the error condition is acknowledged. The only transition is to the “ready” state

## Reference documents

List of CiA documents to which the user should refer

- [1] CiA DS301 - CANopen Application Layer and Communication Profile
- [2] CiA DS401 - CANopen Device Profile for generic I/O Modules

## Accessories, Spare Parts and Warranty

Power Supply 45W 24Vdc 2A	AP-S2/AL-DR45-24
Power Supply 120W 24Vdc 5A	AP-S2/AL-DR120-24
Additional Terminal Block 2x11	AP-S2/TB-211-1
Female Plug 11 Screw clamp	AP-S2/SPINA-V11
Female Plug 11 Spring clamp	AP-S2/SPINA-M11
RJ45 terminated cable 14cm	AP-S2/LOCAL-BUS76
RJ45 terminated cable 22cm	AP-S2/LOCAL-BUS152
CAN termination Adapter	AP-S2/TERM-CAN

## Emergency messages

The module automatically sends emergency messages including error codes. The communication errors are described in CiA DS301 [1]. The error codes are expressed as a DEVICE SPECIFIC ERROR type of code. The codes indicating a specific condition are also inserted, following the table below:

Error code	Error
0000000000	<b>No error</b> –This code is generated when exiting an error condition, to notify the end of one of the error states
0000000007	<b>Error Wrong Command</b> –An attempt to execute a command from an illegal state

Emergency Message	0	1	2	3	4	5	6	7
	01h	FFh	21h	00h	00h	00h	00h	0yh

CQB - ID = [entry.1014h] + NodeID

**Warranty: 3 years excluding defects due to improper use**

## Parameter Store/Restore

This module allows parameters to be saved in a non volatile memory. In order to avoid storing parameters by mistake, storage is only executed when a specific signature is written to the appropriate subindex. The signature is "save".

Similarly, the default values of parameters, according to the communication or device profile, are restored. On receipt of the correct signature in the appropriate subindex, the device restores the default parameters and then confirms the SDO transmission. The signature is "load".

The new configuration becomes active after a reset, i.e. after a "Power OFF/Power ON cycle" or an NMT "Reset Node" message.

## Object Dictionary (with default values)

**⚠** In order to configure the module, it is necessary to connect it to a PC with the CAN interface and the supervisory software installed. The configuration can be obtained by writing the desired values to the module's variables listed in the Object Dictionary.

### Object Dictionary structure

Index (hex)	Sub Index	Object	Name	Default [hex]	Type	Acc. Attr.	MO
1000	VAR	Device Type	00020191	UNSigned32	RO	M	
1001	VAR	Error Register	00	UNSigned8	RO	M	
1003	ARRAY	Predefined error field	00000000	UNSigned32	RO	O	
1005	VAR	COB-ID SYNC	00000080	UNSigned32	RW	O	
1006	VAR	Communication cycle period	00000000	UNSigned32	RW	O	
1007	VAR	Synchronous window length	00000000	UNSigned32	RW	O	
1008	VAR	Manufacturer Device Name	"08RL"	Vis-String	const	O	
1009	VAR	Manufacturer Hardware Version	"1.00"	Vis-String	const	O	
100A	VAR	Manufacturer Software Version	"1.00"	Vis-String	const	O	
100C	VAR	Guard Time	0000	UNSigned16	RW	O	
100D	VAR	Life Time Factor	00	UNSigned8	RW	O	
1010	ARRAY	Store Parameters		UNSigned32	RW	O	
00h	VAR	Largest subindex supported	01	UNSigned8	RO		
01h	VAR	Save all parameters	03	UNSigned32	RW		
1011	ARRAY	Restore Default Parameters		UNSigned32	RW	O	

00h	VAR	Largest subindex supported	01	UNSigned8	RO	
01h	VAR	Restore all default param.	01	UNSigned32	RW	
1014	VAR	COB-ID EMCY	80+NodeID	UNSigned32	RW	O
1015	VAR	Inhibit Time EMCY	0000	UNSigned16	RW	O
1017	VAR	Producer heartbeat time	0000	UNSigned16	RW	O
1018	RECORD	Identity Object		Identity (23h)	M	
00h	VAR	Number of entries	01	UNSigned8	RO	
01h	VAR	Vendor ID	000000E9	UNSigned32	RO	
1200	RECORD	Server SDO Parameters				
00h	VAR	Number of entries	02	UNSigned8	RO	O
01h	VAR	COB-ID Client -> Server	600+NodeID	UNSigned32	RO	
02h	VAR	COB-ID Server -> Client	580+NodeID	UNSigned32	RO	
1400	RECORD	1 <sup>st</sup> Receive PDO Comm Param.		PDO CommPar (20h)	M	
00h	VAR	Largest subindex supported	02	UNSigned8	RO	
01h	VAR	COB-ID used	200+NodeID	UNSigned32	RW	
02h	VAR	Transmission type	FF *	UNSigned8	RW	
1401	RECORD	2 <sup>nd</sup> Receive PDO Comm Param.		PDO CommPar (20h)	M	
00h	VAR	Largest subindex supported	02	UNSigned8	RO	
01h	VAR	COB-ID used	300+NodeID	UNSigned32	RW	
02h	VAR	Transmission type	FF *	UNSigned8	RW	
1600	RECORD	1 <sup>st</sup> Receive PDO Mapping		PDO Mapping (21h)	M	
00h	VAR	No. of mapped application obj.	01	UNSigned8	RO	
01h	VAR	Write Output 1 – 8	62000108	UNSigned32	RO	
1601	RECORD	2 <sup>nd</sup> Receive PDO Mapping		PDO Mapping (21h)	M	

Index (hex)	Sub Index	Object	Name	Default [hex]	Type	Acc. Attr.	MO
00h	VAR	No. of mapped application obj.	01	UNSigned8	RO		
01h	VAR	Start Stop Mode	200D0008	UNSigned32	RO		
2003	ARRAY	Output Option	00	UNSigned8	RW	O	
200B	ARRAY	Value Output Pulse		UNSigned16	O		
00h	VAR	Number of Entries	08	UNSigned8	RO		
01h	VAR	Output Pulse 1 Value	0000	UNSigned16	RW		
02h	VAR	Output Pulse 2 Value	0000	UNSigned16	RW		
03h	VAR	Output Pulse 3 Value	0000	UNSigned16	RW		
04h	VAR	Output Pulse 4 Value	0000	UNSigned16	RW		
05h	VAR	Output Pulse 5 Value	0000	UNSigned16	RW		
06h	VAR	Output Pulse 6 Value	0000	UNSigned16	RW		
07h	VAR	Output Pulse 7 Value	0000	UNSigned16	RW		
08h	VAR	Output Pulse 8 Value	0000	UNSigned16	RW		
200C	VAR	Operating Mode	01	UNSigned8	RW	O	
200D	VAR	Start Stop Mode	00	UNSigned8	RW	O	

3000	VAR	Node Address	7F	UNSigned8	RO	O
3001	VAR	Node Baudrate	01	UNSigned8	RO	O
6200	ARRAY	Write Output 8 – bit		UNSigned8	M	
00h	VAR	Number of entries	06	UNSigned8	RO	
01h	VAR	DigOutput8_1	00	UNSigned8	RW	
6202	ARRAY	Polarity Output 8 – bit		UNSigned8	O	
00h	VAR	Number of entries	01	UNSigned8	RO	
01h	VAR	Polarity8_1	00	UNSigned8	RW	
6206	ARRAY	Error Mode Output 8 – bit		UNSigned8	O	
00h	VAR	Number of entries	01	UNSigned8	RO	
01h	VAR	ErrorMode8_1	FF	UNSigned8	RW	
6207	ARRAY	Error Value Output 8 – bit		UNSigned8	O	
00h	VAR	Number of entries	01	UNSigned8	RO	
01h	VAR	ErrorValue8_1	00	UNSigned8	RW	
6208	ARRAY	Filter Mask Output 8 – bit		UNSigned8	O	
00h	VAR	Number of entries	01	UNSigned8	RO	
01h	VAR	FilterMask8_1	FF	UNSigned8	RW	

\* The factory set (value present in the modules when new) for the transmission type is: **01h**.